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CONTENT BASED IMAGE RETRIEVAL SYSTEM WITH SEMANTIC INDEXING AND RECENTLY RETRIEVED IMAGE LIBRARY

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Abstract

Content based image retrieval system is a fast growing research area, where the visual content of a query image is used to search images from large scale image databases. Retrieval process includes, submitting a query, and extracting images that best matches the user request. The query may be text-based or Image-based. In small collection of images simple browsing can identify an image. This is not the case for large and varied collection of images, where the user encounters image retrieval problem. Image retrieval problem is the problem of searching and retrieving images that are relevant to a user's request from a database. Generally, Low level features, representing color, shape, and texture extracted form an image to represent its content. In a typical CBIR the features of the images in the database are extracted and indexed accordingly. In this proposed an effective system, both the semantically and visually relevant features are used to retrieve the related images. The object wise features of query image are utilized for the effective retrieval. Moreover, an active Recently Retrieved Image Library (RRI Library) is used, which increases the accuracy in each retrieval. An RRI library uses an index system, which maintains the recently retrieved images, and during the retrieval process, the proposed system searches the pertinent images from both the database as well as the RRI library and hence the retrieval precision is gradually increased in each retrieval. The proposed CBIR method is evaluated by querying diverse images and the retrieval efficiency is analyzed by calculating the precision-recall values for the retrieval results.

Keywords: Content based image retrieval, Low level features, High Level features, Recently Retrieved Image Library, Image Segmentation, k-mean algorithm, precision-recall values

Introduction

Image retrieval systems browse, SEARCH and retrieve images from a huge database of digital images [7]. Pictorial queries based retrieval of image data is emerging as an interesting and challenging problem with the advancement of the multimedia network technology and the growth of image data. A method used for retrieving similar images from an image database, called Content Based Image Retrieval (CBIR) [3] [4]. has emerged as a hot topic in technical research [1]. CBIR has diverse applications in internet, multimedia, medical image archives, crime prevention, entertainment, and digital libraries [13] and it is an important field in image processing [2].

Visual contents, commonly called as features are used by CBIR to search images from large scale image databases according to the requests of the user which is provided in the form of a query image [12]. It is essential for features of an image to have a sound relationship with the semantic meaning of the image. By comparing the features of the query image with the features of the images present in the database the CBIR system retrieves relevant images from the image database for s given query image [14] [5]. Based on the low level or high level features used for retrieval, the CBIR systems can be classified into different types [11].

CBIR systems that use low-level features for retrieval identifies the data base images that have visual similarity with the query image by comparing the low-level image features [8] like color, texture, shape and structure that are extracted from the images [9] [10]. The high-level description is an attributed graph attained by the structural representation of the image [16]. Compared to low level features, extraction of high level features is more difficult, even though they are more preferable for retrieval of images, particularly where human perception is more important [6]. Bridging the gap between low-level feature layout and high-level semantic concepts is the most challenging aspect of CBIR [15].

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Related works

Reddy *et al.* [17] have proposed a method called semantic indexing using high level features. The capability of their approach in retrieving images of diverse shape, colors and size has been evident from their results. Secondly images possessing largest area have been retrieved correctly. Their system also has certain drawbacks. Images having small segment size are not satisfactorily processed by their approach.

Kulkarni *et al.* [18] have proposed architecture for association-based image retrieval (ABIR) based model-based ATR system. Military vehicles have been successfully recognized using the system. A generalized bi-directional associative memory (GBAM) with a tree topology has been used in the descriptive examples. But, alternative topologies like star, bus, or ring could be utilized for GBAM. The bus topology is more suitable for retrieving temporal images. Issues related to the updating process have been raised by the generalization of a BAM to diverse vector fields. Synchronous update has been performed in a BAM on all units in a field. Contrary to this, sequence of updating weights has not been obvious in a GBAM. Interconnection issues have also been raised by the generalization of a BAM to diverse fields. Furthermore, considering the capacity of the generalized BAM has also been essential. The capacity of the GBAM and the size of the feature vector affect the number of images that can be stored and retrieved. GBAMs have been useful in multimedia applications for association-based image storage and retrieval.

Sudhamani and Venugopal [28] have focused on a low-dimensional color based indexing technique for achieving efficient and effective retrieval performance. Here, the color features are extracted using the mean shift algorithm, a robust clustering technique. The feature descriptor consists of the representative color of a region and was indexed using a spatial indexing method that uses R^* -tree thus avoiding the high-dimensional indexing problems associated with the traditional color histogram. Alternatively, the images in the database are clustered based on region feature similarity using Euclidian distance. Only representative features of these clusters are indexed using R^* -tree thus improving the efficiency. For similarity retrieval, each representative color in the query image or region was used independently to find regions containing that color. Euclidean similarity measure was defined for the proposed method. Experimental results show that the proposed method was fast and accurate over R^* -tree and sequential search methods. The proposed method can be used for color-based image retrieval where the fastness and accuracy of the result was the requirement. The same work will be extended for over 5000 natural images to test the efficiency and accuracy of the retrieval.

Hossein Nezamabadi-pour and Saeid Saryazdi [29] have proposed an object-based image indexing. For each block of size 8*8 in DCT domain a feature vector was extracted. Then, feature vectors of all blocks of image using a k-means algorithm was clustered into groups. Each cluster represents a special object of the image. Then they select some clusters that have largest members after clustering. The centroids of the selected clusters were taken as image feature vectors and indexed into the database. Also, they proposed a method for using image indexing method in automatic image classification. Experimental results on a database of 800 images from 8 semantic groups in automatic image classification are reported. The effective image indexing technique was presented that extracts features directly from DCT domain. Then, feature vectors of all blocks of an image using the k-means algorithm was clustered into groups. Each cluster represents a special object of the image. Then select some clusters that have largest members after clustering. The centroids of the selected clusters were taken as image feature vectors and indexed into the database. The average accuracy of image classifier was 88.38%.

Premchaiswadi *et al.* [20] have presented both high level and low level features based joint querying and relevance feedback scheme for on-line Content-Based Image Retrieval System. Low-level features of images have been extracted and indexed by introducing a color correlogram (CC) and auto correlogram (AC) algorithms based fast and efficient color feature extraction called auto color correlogram and correlation (ACCC). An image analysis algorithm has been included in the text-based image search engines without affecting their response time by a proposed framework of multi-threaded processing. Their scheme has been proved to remarkably improve the retrieval performance of existing image search engine by means of the coverage ratio measure based experimental evaluations

Wang *et al*. [21] have proposed a method for extraction and representation of spatial relationships semantics of objects among objects existing in images. Low level features extraction incorporated with proposed line detection techniques has been used as the basis for recognizing all objects. Minimum Bound Region (MBR) with a reference coordinate has been used for representing objects. Spatial relation among objects has been calculated using the reference coordinate. The 8 spatial relationship concepts that have been calculated are "Front", "Back", "Right", "Left", "Right-Front", "Left-Front", "Right-Back", "Left-Back". Translation of user query in text form to semantic meaning and representation has been automatically performed. Spatial relationships semantic have been proposed in addition to the image similarity of objects.

Feature Extraction

The performance of the CBIR system usually depends upon the features adopted to represent the images in the database. The proposed CBIR technique will use both the human perception as well as machine level perception. Proposed system also uses a recently retrieved image library for the retrieval of the system. The proposed Image retrieval system consists of two steps namely feature extraction and retrieval phase. We focus on considering four popular features, namely, shape, texture, color and homogeneity features. The shape, color, texture and homogeneity features are the low level features used in this CBIR for retrieval. The image features are either extracted from the whole image or from the regions. As it is found that the users are mostly interested in specific region as compared to the entire image, the proposed system extracts shape, color and texture features region wise. After the completion of the feature extraction, the query image features compared with the database image features and recently retrieved image library. Hence the images which have similar low level features are retrieved.

Low Level Feature Extraction

The visual contents of an image are analyzed by using the low level features such as shape, texture and color of the image. As it is found that the users are mostly interested in specific region as compared to the entire image, the proposed system extracts shape, color and texture features region wise.

Color based Region Segmentation

Usually most of the images are rich in color. In the proposed technique the different objects in the image are segmented on the basis of the colors. In our proposed segmentation technique the number of different colors present in the image each pixel $a_{x,y}$, we can calculate the local color contrast. $\alpha_{x \times y}$ as follows.

$$\alpha_{x \times y} = \frac{\left\| \delta_{xy} - \bar{\delta}_{xy} \right\|}{\left\| \bar{\delta}_{xy} \right\|} \qquad (1)$$

Where $\bar{\delta}_{xy}$ the average of a color in the small neighborhood around δ_{xy} and $\|.\|$ represents the norm of the vector. The pixel $a_{x,y}$ is considered as an edge if its contrast exceeds a predefined value threshold λ.

In the next step, to distinguish between the different uniform regions, texture areas, and contour points, we use a sliding window to estimate the different characteristics of image such as mean η , and variance ϑ, of edge density for each pixel. Different Pixels labeled as noise components are removed firstly and there color is changed to the corresponding uniform color. The amount of smoothing is larger for the uniform pixels as human eye usually creates a perception on a single dominant color which is within uniform regions. For the highest amount related to the smoothing of the radius and smoothing kernels are chosen adaptively for each uniform pixel. These smoothing kernels are chosen depending on the distance to the closest edge (color or texture). Color edge and textured edge are not filtered while the edge pixels are not used while computing color composition as the edges do not contribute to the way humans describe color content. Finally, the amount of averaging is performed in the textured areas and is chosen based on the edge density, so that amount of averaging is higher for fine textures and lower for coarse textures. Thus the perceived color at location (x, y), $\rho(x, y)$ is as follows,

$$\rho(x, y) = (\rho * g\hbar_{xy})(x, y) \qquad (2)$$

Where * is the convolution operator and $g\hbar_{xy}$ is the Gaussian kernel which is defined as

$$g\hbar_{x_a y_a} = k \exp(x^2 + y^2 / \sigma^2); g\hbar_{x_a y_a} = 1 \qquad (3)$$

Shape feature extraction

An efficient and robust representation of shape feature plays an important role in image retrieval. These features should also be independent of different characteristics such as translation, rotation, and scaling of the shape [21]. To extract the shape feature from the image, initially, the image in RGB color space is converted to gray scale image. RGB color is a format for color images and it represents an image with three matrices of sizes matching the image is reduced to 128. The LGB vector quantization algorithm is used in proposed technique to obtain the set of different colors which will represent image colors in lab space (with respect to mean square error). For format, where each matrix corre-

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sponds to one of the colors such as red, green and blue [22]. When we convert this image into a grey scale (or "intensity") image, it will depend on the sensitivity response curve of detector to light as a function of wavelength [23] [24]. Let a_r, a_g and a_b be the R,G,B weights of the image a respectively.

$$\hat{a} = 0.2989 * a_r + 0.5870 * a_g + 0.1140 * a_b \quad (4)$$

The above equation is the Craig's formula for converting RGB color image to gray scale image. After performing grey color conversion, the noise in the image is filtered by using the mean filter.

Pseudo code-1: Mean filter

Input : **Image** $\hat{a}_{mn}$

Output : The Resultant Solution Clusters

Parameters: W_w →Window Width

W_h → Window Height

Pseudocode:

$e_w \leftarrow W_w / 2$

$e_h \leftarrow W_h / 2$

$for\ \ i = e_w, \cdots, (W_w - e_w)$

$for\ \ j = e_h, \cdots, (W_h - e_h)$

Allocate $C[M][N]$

$for\ \ f_i = 0, \cdots, W_w$

$for\ \ f_j = 0, \cdots, W_h$

$C\ [f_i][f_j] \leftarrow P[i + f_i - e_w][j + f_j - e_h]$

sort C in asc;

$P[i][j] \leftarrow C[W_w / 2][W_h / 2];$

end for

end for

end for

end for

Mean filtering is a method of smoothing images. The idea of mean filtering is simply to the Pseudo code-1 shows the process of mean filter. The noise removed image is subjected to k-means clustering for the shape retrieval. The pixels of the noise-free image form a 2D vector P ; this 2D vector is subjected to clustering to detect different shapes present in the image. Clustering is the process of grouping samples so that the samples are similar within each group. The groups are called clusters [26]. Various regions in the image are discovered by identifying groups of pixels that have similar gray levels, colors or local textures utilizing clustering in the image analysis. There are many clustering techniques present. In our work, we make use of the K-means clustering algorithm for image segmentation for the further process.

K-means clustering treats every object as having its different locations in space. It finds partitions such that objects within each cluster which are as close to each other as possible, and as far from objects in other clusters as possible [26]. To perform the K-means clustering it is necessary to find out the number of clusters to be partitioned and a distance metric for quantifying the distance between two objects. Prior to the application of K-means clustering on the image, which is in the form of 2D vector, is rescaled to a 1D vector. Subsequently, the k-means algorithm is applied, to cluster the image.

The Canny edge detection operator was developed by John F. Canny in 1986 and it uses a multistage algorithm to detect a wide range of different edges in images. In addition to it canny edge detector is a complex optimal edge detector which takes comparatively longer time in result computations [27]. The canny algorithm consists of mainly five steps, they are smoothing, finding gradients, non-maximum suppression, double thresholding and edge tracking by hysteresis

Mean filtering

Mean filter is applied over I_i^{gray} after segregating it into various blocks. The segregated blocks can be represented as $B_{ij} : 0 \le j \le N_B - 1$, in such a way that $B_{ij} \subseteq I_i^{gray}$, where N_B is the number of blocks are in spatial domain. The resultant application of mean filter can be denoted as

$$B_{ijk}^{\mu} = M(B_{ij}) : 0 \le k \le |B| - 1 \quad (5)$$

$$M(B_{ij}) = \frac{1}{|B|} \sum_{k=0}^{|B|-1} B_{ijk} \quad (6)$$

Where, $M(\cdot)$ is the filter function, B_{ijk}^{μ} is the filtered blocks for which the size can be determined as $|B| = \frac{M \times N}{N_B}$

The Craig's formula has been applied for the conversion of RGB to gray scale image and then the mean filter is applied on the converted gray scale image to remove the noises. The mean filter smoothens the image data, thus the noise has been eliminated. Using the grey level values, this filter performs spatial filtering on each individual pixel in an image in a square or rectangular window surrounding each

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pixel. And then the filtered image has been clustered to identify the various regions in the image and this can be discovered by identifying groups of pixels that have similar gray levels, colors or local textures utilizing clustering in the image analysis.

Pseudo code-2 : K-means Algorithm

Input : $\hat{\hat{a}}_{x,y}$

$K - number$ of clusters

Output: set of K clusters

Step 1: Arbitrarily select K data items from P as initial centroids.

Step 2: Repeat

- Assign remaining P apart from the selected initial centroids to the cluster K ,which has the closest centroid
- Calculate the new centroid for each cluster Until convergence occurs

Texture and Color Intensity Level Extraction:

There are several common textures consist of small textons that are usually in very large number is perceived as isolated objects. These elements are placed more or less regularly or randomly. The texture features are extracted by using the gray level difference method (GLDM). In this GLDM, diverse images are created in the four directions and then a feature vector is generated by linear zing the gray level histograms of these four new images. The classes of simple image properties that can be used for texture analysis are first order statistics of local property values. In particular, a class of local properties based on absolute differences between pairs of gray levels or of average gray levels has been sometimes used. Here in our process we used gray level difference method for diverse images and it created in four directions and then a feature vector is generated by linear zing the gray level histograms of these four new images.

RETRIEVAL PHASE

The features are extracted for all the images in the database and stored in feature database. The query image is match up to the images in the database for image retrieval. After the extraction of images using shape, color, texture and homogeneity feature extraction, the extracted images are stored in the feature database. A semantic name is given to all the images, which is stored in the database, are also one of the high-level features of the image. After extraction process the feature set from the database images, it is necessary to compare all of these feature sets with the given query image's feature set. The relevant images which will satisfy the low level feature of the query images is retrieved firstly and stored in low feature image library and then images which satisfy the high level feature are extracted and stored in high feature image library. Based on the similarity of images which exists in low-level library, high-level library, and also in Recency-based retrieved image library (RRI library) related to the query image are retrieved. Thus the system mainly focused on retrieving images after extraction of features and retrieving images. The feature set of the recovered relevant images are stored with syntactic name index in RRI library for future reference.

EXPERIMENTAL RESULTS OF CBIR SYSTEM WITH RRI LIBRARY

In our research the content based image retrieval technique is used for retrieving the images from the database for the query images. Here the large database consists of various types of images and the image retrieval process is carried out by using our proposed method for the query of different images. In our CBIR system, we combine the features of low level extraction process and high level feature extraction and here we generalized the shape feature extraction. In general, a good shape feature descriptor has the essential properties such as identify ability, translation, rotation, scale, affine and occultation invariance and statistically independent. Therefore the below figure 2 and figure 3 shows the shape feature extracted output and segmented output for the query input images dinosaur and elephant respectively. After segmentation and shape feature extraction process in low level feature extraction, high level feature extraction process will be carried out and then image retrieval takes place after the completion of all these process.

Fig.1 Input query images of dinosaur, elephant for our Presented system

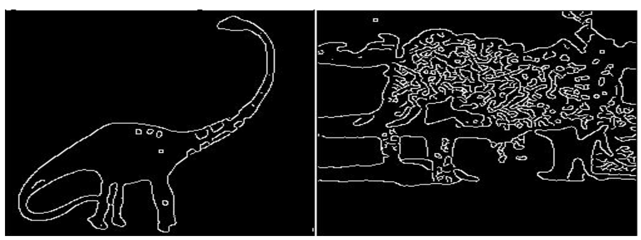

Fig. 2 shape feature extracted output for the Image dinosaur, elephant

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Fig.3 segmented output for the query image dinosaur, elephant

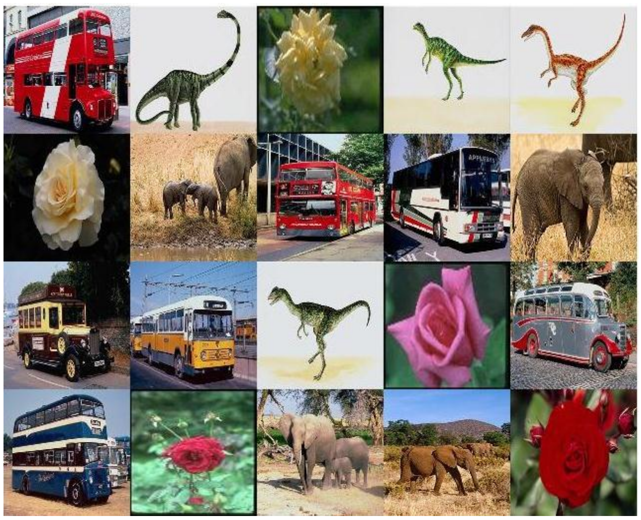

Fig.4 The low-level feature extraction for the query dinosaur

Fig. 5 The low-level feature extraction for the query elephant

Fig. 6 The high-level feature extraction for the query dinosaur

CONCLUSION

In this paper a content based image retrieval system was Proposed for effective retrieval of the relevant images from the image database. The system is intended to use both the high and low level feature of the images for retrieval purpose which decrease the semantic gap between low level and high level features. The system was implemented and experimented with varying query images. The analytical results confirmed that the proposed technique showed better performance than the classical CBIR system. It also proved that the performance of the proposed system with RRI library was improving at remarkable rate in each successive retrieval. From all the afore described analytical results, it can be assertively concluded that the proposed system shows good performance than the conventional hierarchical system.

Input query Image	**Low level feature extraction**	**High level feature extracted**
Elephant	2	37
Dinosaur	5	20

Table 1: Retrieved Images using Low and High Level Feature Extraction

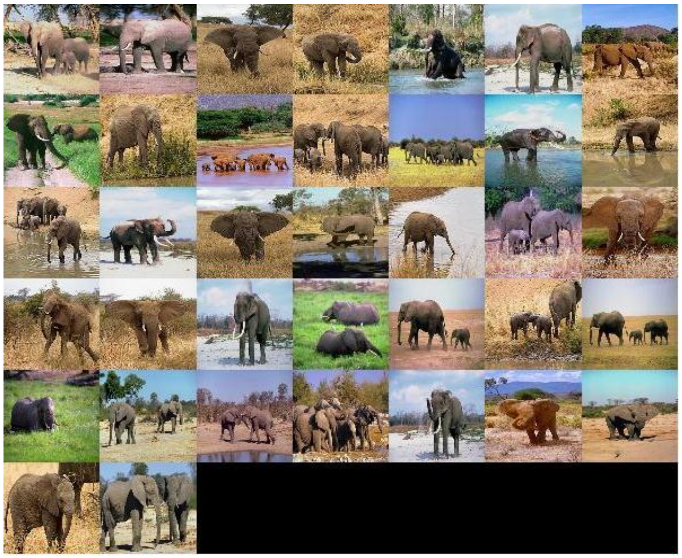

Fig.7 The high-level feature extraction for the query elephant

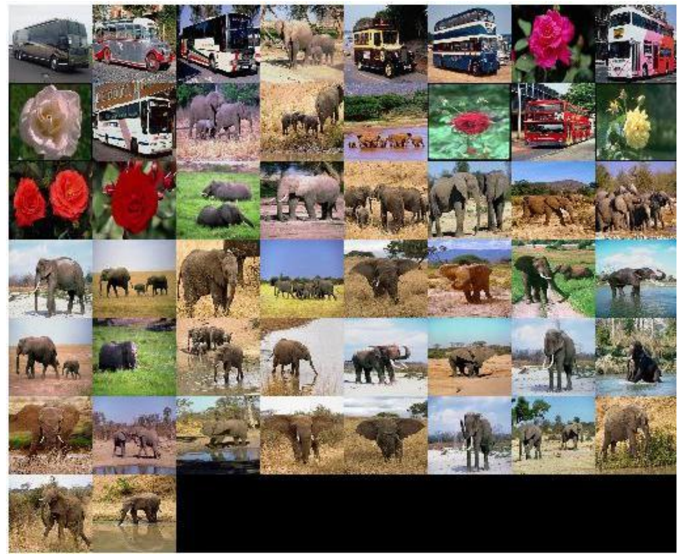

Fig. 9 The common feature extraction for the query elephant

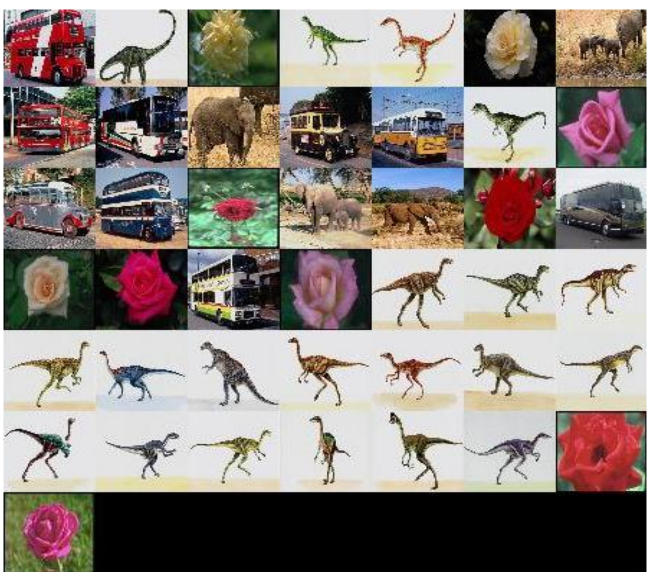

Fig.8 The Common Feature Extraction for the query Image 'dinosaur'

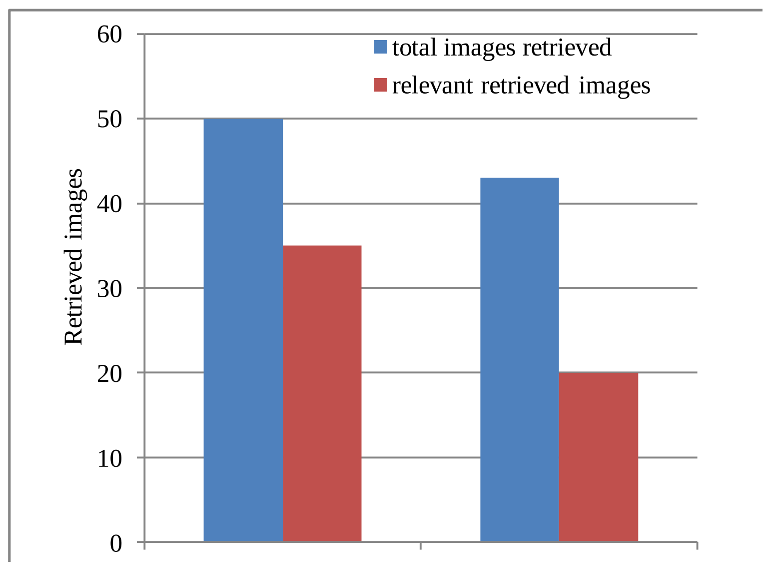

Fig.10 Relevant retrieved images from the total retrieved Images for the query input images elephant, dinosaur

Table 2: Shows the relevant retrieved images from the total retrieved images for the query input images dinosaur, elephant

Input query Image	Total number of Images Retrieved	Relevant Images Retrieved
Elephant	50	35
Dinosaur	43	20

References

[1] Jianhua Wu, Zhaorong Wei and Youli Chang, "*Color and Texture Feature for Content Based Image Retrieval*", International Journal of Digital Content Technology and its Applications, Vol.4, No.3, pp: 43-49, June 2010.

[2] Ch. Srinivasa Rao , S. Srinivas Kumar and B. Chandra Mohan," *Content Based Image Retrieval using Exact Legendre Moments and Support Vector Machine*", The International Journal of Multimedia and its Applications (IJMA), Vol.2, No.2,pp: 69-79, May 2010.

ISSN:2319-7900

[3] Hiremath and Jagadeesh Pujari, "*Content Based Image Retrieval based on Color, Texture and Shape features using Image and its complement*", International Journal of Computer Science and Security, Vol. 1, Issue. 4, pp: 25-35, 2007.

[4] Suresh Pabboju and A. Venu Gopal Reddy, "*A Novel Approach for Content-Based Image Indexing and Retrieval System using Global and Region Features*", International Journal of Computer Science and Network Security, Vol.9 No.2, pp: 119-130, Feb 2009.

[5] Ch. Srinivasa rao , S. Srinivas kumar and B.N. Chatterji, "*Content Based Image Retrieval using Contourlet Transform*", ICGST-GVIP Journal, Volume 7, Issue 3, pp:9-15, November 2007.

[6] Awais Adnan, Muhammad Nawaz, Sajid Anwar, Tamleek Ali and Muhammad Ali, "*Object Identification with Color, Texture, and Object-Correlation in CBIR System*", World Academy of Science, Engineering and Technology, Vol.64, pp.117-122, 2010.

[7] Murthy, Vamsidhar, Swarup Kumar and Sankara Rao, "*Content Based Image Retrieval using Hierarchical and K-Means Clustering Techniques*", International Journal of Engineering Science and Technology, Vol.2, No.3, pp.209-212, 2010.

[8] G. Sasikala, R. Kowsalya, M. Punithavalli, "*A Comparative Study of Dimension Reduction Techniques for Content-Based Image Retrieval*", The International journal of Multimedia & Its Applications (IJMA) Vol.2, No.3, pp: 40-47, August 2010.

[9] Rajshree S. Dubey, Rajnish Choubey and Joy Bhattacharjee, "*Multi Feature Content Based Image Retrieval*", International Journal on Computer Science and Engineering, Vol. 2, No. 6, pp: 2145-2149, 2010.

[10] Christoper C. Yang, "*Content Based Image Retrieval: a Comparison between Query by Example and Image Brousing Map Approaches*", Journal of Information Science, Vol.30, No.3, pp: 254-267, 2004.

[11] Hui Hui Wang, Dzulkifli Mohamad, N.A Ismail, "*Image Retrieval: Techniques, Challenge, and Trend*", World Academy of Science, Engineering and Technology Vol.60, pp: 716-718, 2009.

[12] Nandagopalan, Adiga and Deepak, "*A Universal Model for Content-Based Image Retrieval*", World Academy of Science, Engineering and Technology, Vol.46, 2008.

[13] Srinivasa Rao and Srinivas Kumar, "*Content Based Image Retrieval using Contourlet Sub band Decomposition,*" In Proceedings of IEEE International Conference, SPIT Colloquium, Mumbai, pp.140-145, February 2008.

[14] Thomas M. Deserno, Sameer Antani and Rodney Long, "*Ontology of Gaps in Content-Based Image Retrieval*", Journal of Digital Imaging, Vol. 22, No. 2, 2009

[15] Hiremath and Jagadeesh Pujari, "*Content Based Image Retrieval using Color Boosted Salient Points and Shape features of an image*", International Journal of Image Processing, Vol.2, No.1, pp. 10-17, 2008.

[16] Mark Ewald, "*Content-Based Image Indexing and Retrieval in an Image Database for Technical Domains*", Transactions on Machine Learning and Data Mining, Vol. 2, No 1, pp: 3-22, 2009.

[17] Ganapathi Reddy, Babu and Somasekhar, "*Image Retrieval by Semantic Indexing*", Journal of Theoretical and Applied Information Technology, Vol.5, No.6, pp.745-750, 2005.

[18] Arun Kulkarni, Harikrisha Gunturu and Srikanth Datla, "*Association-Based Image Retrieval*", WSEAS Transactions on Signal Processing, Vol. 4, No.4, pp.183-189, 2008.

[19] Preeti Aggarwal, Sardana and Gagandeep Jindal, "*Content Based Medical Image Retrieval: Theory, Gaps and Future Directions*", ICGST-GVIP Journal, Vol.9, No.2, pp. 27-37, 2009.

[20] Wichian Premchaiswadi and Anucha Tungkatsathan, "*On-line Content-Based Image Retrieval System using Joint Querying and Relevance Feedback Scheme*", WSEAS Transactions on Computers, Vol.9, No.5, pp. 465-474, 2010.

[21] Hui Hui Wang, Dzulkifli Mohamad and Ismail, "*Semantic Gap in CBIR: Automatic Objects Spatial Relationships Semantic Extraction and Representation*", International Journal of Image Processing (IJIP), Vol.4, No.3, 192-204, 2010.

[22] Nbhan D. Salih and David Chek Ling Ngo, "*A Novel Method for Shape Representation*", In proceedings of ICGST International Conference on Graphics, Vision and Image Processing (GVIP-05), Egypt, December 2005.

[23] Shi Z, Setlur S, Govindaraju V," *Digital Enhancement of Palm Leaf Manuscript Images using Normalization Techniques*", 5th International Conference On Knowledge Based Computer Systems, 2004 December 19-22, 2004 Hyderabad, India; 2004.

[24] Surinta O, Nitsuwat S. Handwritten , "*Thai Charactr Recognition Using Fourier Descriptors and Robust C-Protytype*" , Information Technology Journal, June 2006.

[25] Surinta, O. and Chamchong, R., "*Proceedings in IFIP International Federation for Information Processing*", Vol 288, pp. 182–189.2008.

[26] Ravichandran and Ananthi, "*Color Skin Segmentation Using K-MeansCluster*",International Journal of Com-

ISSN:2319-7900

putational and Applied Mathematics, Vol.4, p.153-157, 2009.

[27] Vincent and Folorunso, "*A descriptive algorithm for sobel image edge detection*", in proceedings of Informing Science & IT Education Conference(InSITE), 2009.

[28] M. V. Sudhamani, and C. R. Venugopal, "*Grouping and Indexing Color Features for Efficient Image Retrieval*," World Academy of Science, Engineering and Technology, Vol. 27, pp. 194-199, 2007.

[29] Hossein Nezamabadi-pour and Saeid Saryazdi, "*Object-Based Image Indexing and Retrieval in DCT Domain using Clustering Techniques*", World Academy of Science, Engineering and Technology 3 pp. 98-101, 2005.

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